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A COMPARISON OF THREE ANTITRANSPIRANTS FOR REDUCING WATER LOSS IN BLACK SPRUCE CONTAINER SEEDLINGS

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Introduction

Seedling dessication is a problem in nursery stock production and in plantation establishment. Any means by which seedling dessication can be minimized will be beneficial.

One means by which water loss from tree seedlings can be reduced is the application of film-forming antitranspirants to the foliage. Before recommending antitranspirants for operational use, thorough testing must first be carried out to determine product efficacy and to ensure no damaging side effects are incurred. Since field trials are time consuming and expensive, initial laboratory screening to identify products which warrant field testing is desirable. This report describes the efficacy of three antitranspirants in reducing water loss in black spruce container seedlings.

Materials and Methods

Black spruce seedlings were greenhouse grown at Dryden Tree Nursery in Spencer Lemaire containers in peat moss/vermiculite (3:2, v/v) growing medium from June to October, 1982. In April 1983, approximately 700 of these production run seedlings were transferred to the Midhurst Research Station where they were grown in their containers for a second season. The seedlings were taken to OTIFBI, Maple on October 7, 1983 for treatment with antitranspirants, at which time they averaged 12.7 cm (SD ± 2.4) in shoot length.

In preparation for treatment seedlings were watered to saturation and left overnight to permit the growing medium to drain to field capacity. Each plug was then wrapped in a plastic bag and sealed with a twist-tie at the base of the seedling stem.

Three commercially available antitranspirants: Vapor Gard[1], Clearspray[2] and Folicote[3] were tested at their recommended rates. Vapor Gard was applied at a rate of 5% concentrate in water (v/v) and Clearspray was applied at 20% concentrate in water. Folicote was applied at both its recommended rate of 5%, as well as at a 20% rate. Each seedling was treated by dipping the shoot in the antitranspirant solution. A water-dip was used as the control. In each treatment there were three replicates

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[1]Miller Chemical and Fertilizer Corp., P.O. Box 333, Radio Rd., Hanover, PA. 17331.

[2]W. A. Cleary Chemical Corp., P.O. Box 10, 1049 Somerset St., Somerset, NJ. 08873.

[3]Sunoco Inc., 25 Overlea Blvd., Bldg. #1, Toronto, Ontario, M4H 1B5.

of five seedlings.

The initial weight of each seedling, including saturated growing medium and bag, was determined following the application of the antitranspirants. The seedlings were left unwatered in the laboratory for 28 days, during which periodic weight measurements were made. At the end of the drying period the plugs were unwrapped and the total oven dry weight (after 24 h at 85°C) of each seedling, complete with growing medium, was determined. The total water content was calculated as the difference between initial weight after saturation and oven dry weight. Cumulative weight loss over time was calculated as per cent water loss (grams water lost per grams total water content x 100). Significant differences in water loss were identified using a one-way analysis of variance and the least significant difference (LSD) test at the 5% level (Freese 1962).

Results and Discussion

Vapor Gard was the only antitranspirant tested which significantly reduced water loss (Fig. 1). After 28 days of drying, seedlings treated with Vapor Gard had lost only 22% of their initial water content, whereas the control seedlings had lost 92%.

Folicote and Clearspray applied at recommended rates were ineffective at preventing water loss (Fig. 1). Even when the concentration of Folicote was increased to 20% - four times the recommended rate - control of water loss was not improved.

While Vapor Gard was the only antitranspirant tested which was able to reduce the rate of water loss, it also resulted in toxicity symptoms. Browning of the needles was apparent on 80% of the seedlings by the end of the trial. Visible damage was restricted to the needles at the tips of the main stems and lateral shoots. When the shoot tips of several of the more severely affected seedlings were dissected after day 28, the terminal buds were found to be dead.

No damage was observed in seedlings treated with Folicote or Clearspray. However, these antitranspirants have been reported as causing damage to red pine seedlings in another trial (Davies and Kozlowski 1974). These results demonstrate the need for thorough testing, on a species to species basis, prior to the endorsement of an antitranspirant for nursery use.

It is possible that the poor control of water loss in seedlings treated with Folicote or Clearspray was due to inadequate coverage of the needle surfaces by the antitranspirant film. When needles of seedlings treated with Vapor Gard were examined under a dissecting microscope, a shiny film completely covering the needles was observed. In comparison, Folicote and Clearspray left no apparent film on the needles.

This trial indicated that, of the three products tested, Vapor Gard holds the greatest promise as an antitranspirant for nursery and field use. It remains to be determined whether a lower concentration of Vapor Gard

would be less toxic while still reducing water loss under field conditions.

Literature Cited

Davies, W.J. and T. Kozlowski. 1974. Short- and long-term effects of antitranspirants on water relations and photosynthesis of wood plants. Journal of the American Society of Horticultural Science 99: 297-304.

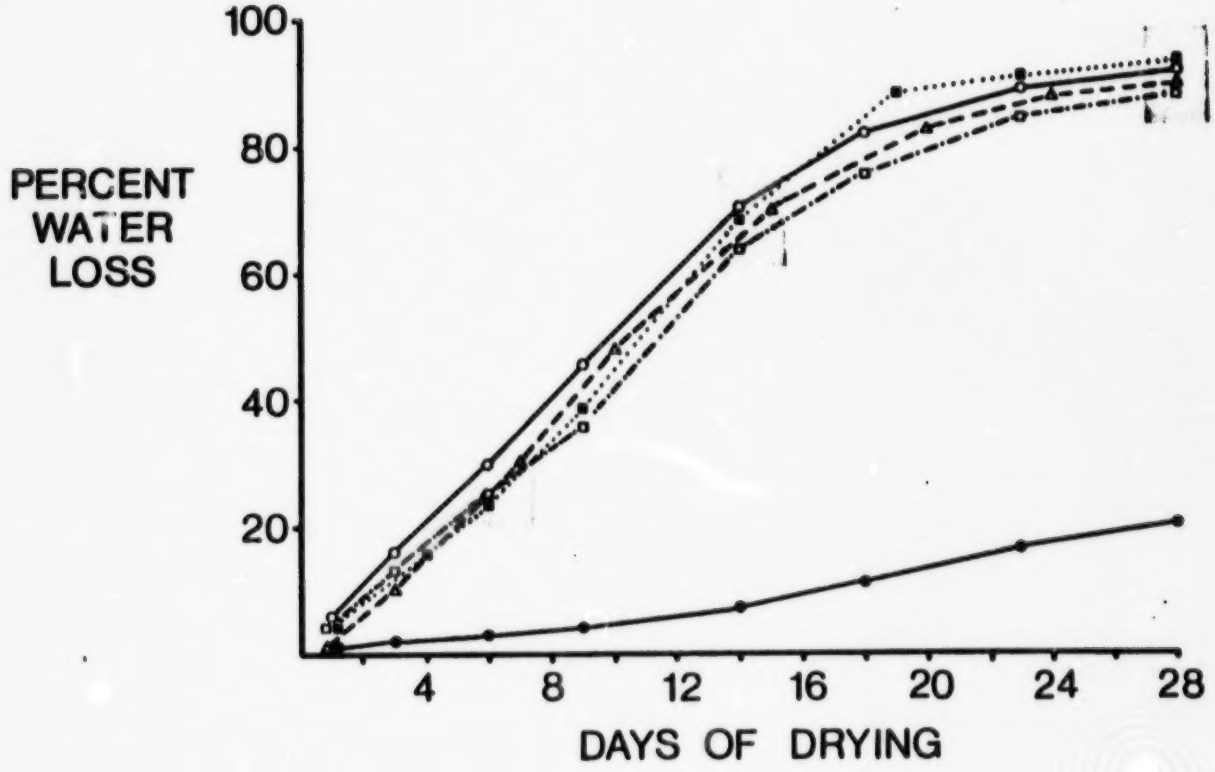

Figure 1 The efficacy of three antitranspirants in reducing water loss from black spruce container seedlings. Points on days 6, 14 and 28 within shaded areas do not differ significantly ($p<0.05$). Control, ○; Clearspray, △; Policote - 5%, □; Policote - 20%, ■; Vapor Gard, ●.